Argonne NATIONAL LABORATORY

National Security

Laser-based photoacoustic probe remotely detects explosives, biological agents

Argonne National Laboratory is developing a portable, remote sensing instrument to detect explosives, toxic chemicals and biological agents in the air or on a surface. This technology will have immediate applications in homeland security protection, detection of toxic gases in the field, environmental monitoring and industrial process control.

The instrument is based on a photoacoustic spectroscopy (PAS) technique that uses a pulsed tunable laser to excite target molecules and a microphone to detect acoustic signals resulting from a "thermal-piston" process. Different from a typical laboratory PAS system that uses an acoustic resonator to enhance the detection sensitivity, Argonne's remote PAS instrument uses a parabolic acoustic reflector and a cylindrical open-air acoustic resonator to enhance the signal-to-noise ratio. Because of its nondestructive nature, the PAS technique can detect target chemicals in all phases.

We have built a laboratory prototype of the remote PAS instrument and demonstrated the feasibility of remotely detecting trace gases. The laboratory system, shown at right, consists of a tunable CO_2 laser, a parabolic reflector, a mechanical chopper and an electret microphone placed inside a reverberant resonator. The reflector was placed about 1.8 meters away from the target area, and the microphone was situated at the focal point of the reflector. Tests were conducted with SF_6 gas injected to the target area. Detected photoacoustic signals showed a fundamental frequency coherent with the chopper frequency.

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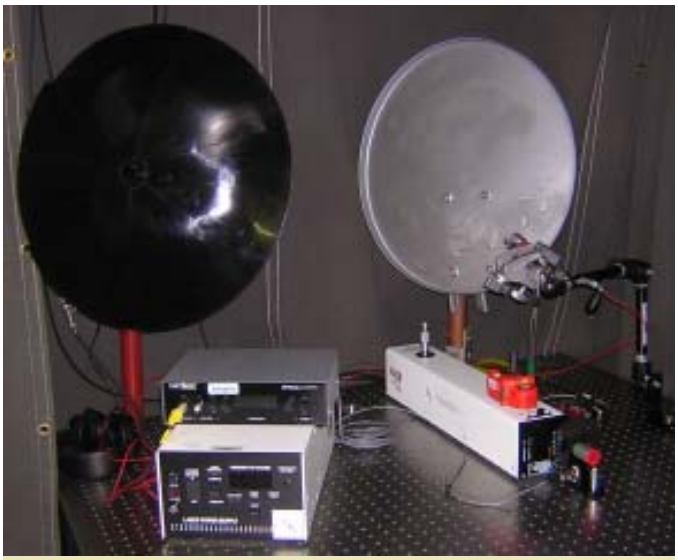

PROTOTYPE – Laboratory prototype of the photoacoustic instrument Argonne National Laboratory is developing for remote sensing of explosives, toxic chemicals and biological agents in the air or on surfaces.

For more information

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